THE STRUCTURE AND DIAGNOSTIC SIGNIFICANCE OF CRATERIFORM BORDERED PITS IN THE VESSELS OF CERCIDIUM

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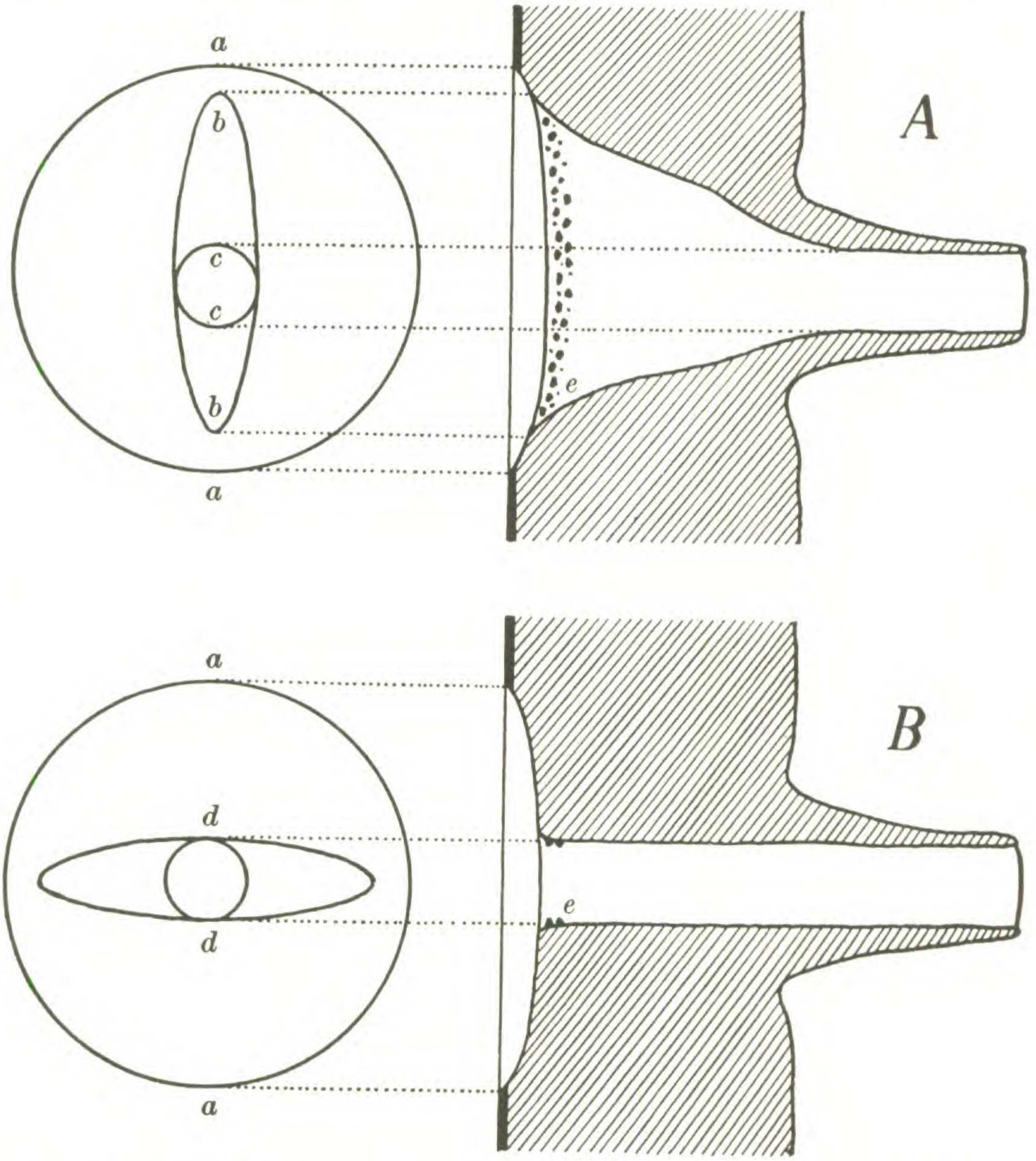
THE PECULIAR PITS in the vessels of *Cercidium australe* Johnston were first described and figured by Tortorelli & O'Donell (1937), who considered them to be "vestured pits" such as occur throughout most of the Leguminosae with the exception of the Bauhineae, Bailey (1933). In connection with my investigations (1950, 1951) of Argentine Leguminosae, I noted certain unusual characteristics of these pits which led me to believe that they merited detailed reinvestigation.

The vessels of *C. australe* are studded internally with projections which resemble miniature volcanic cones. Each of these projections contains a craterlike cavity that extends from its apex through the thick secondary wall of the vessel into the chamber of a bordered pit. According to the terminology adopted by the International Association of Wood Anatomists (1933), an extended opening through a thick secondary wall — which provides a means of communication between the lumen of a cell and the chamber of a bordered pit — is called a "pit canal." A pit canal has an "inner aperture" that opens into the lumen of the cell, and an "outer aperture" that leads into a "pit chamber." Thus, the projections in the vessels of *C. australe* are not a form of vesturing, but are excessive inward extensions of localized parts of the secondary wall which surround the pit canals. True vesturing [1] of the bordered pits in *C. australe* is confined largely to the rim of the outer aperture of the pit canal.

The detailed structure of this aberrant type of bordered pit in *C. australe*, *Fig. 1*, *A* and *B*, differs from the usual type in the following respects. In the case of tracheids and vessels with thin secondary walls, the area of the wall which jackets the pit chamber is embossed inwardly beyond the general contour of the wall which surrounds the lumen of the cell. With increasing thickness of the secondary wall and reduction in size of the pit chamber, this embossing effect is submerged and concealed. In very thick-walled vessels and fiber tracheids, having circular bordered pits, the outer aperture of the pit canal tends to be circular, but of conspicuously smaller diameter than the circular outer contour of the pit chamber. The pit canal flares toward the lumen of the cell by an enlargement of one of its diameters, and the inner aperture usually is more or less narrowly elliptical or slitlike. In the vessels of *C. australe*, on the contrary, the inner aperture of

[1] In my opinion, the term "ornate" is preferable to "vestured." In any case, the Spanish term "orladas" as applied to this type of structure should be changed to "ornadas," the correct translation of both "vestured" and "ornate."



TEXT-FIGURE 1. Crateriform bordered pits in surface and sectional views. (A) Sectioned parallel to the long axis of the outer aperture of the pit canal. (B) Sectioned at right angle to (A). (a-a) Contour of pit chamber, (b-b) contour of outer aperture, (c-c) contour of inner aperture, (d-d) coincident diameters of inner and outer apertures, (e) vestured rim of outer aperture.

the extended pit canal is small and circular. Furthermore, the pit canal flares outwardly, being broadly elliptical at the level of its outer aperture.

TAXONOMIC CONSIDERATIONS

Crateriform bordered pits occur in the vessels of the first-formed, as well as the later-formed, secondary xylem of the stem. Therefore, it is possible to study their occurrence in small twigs from herbarium specimens. Their presence or absence in material obtained from the Arnold

Arboretum (AA), Gray Herbarium (GH), Museo Argentino de Ciencias Naturales (BA), Yale Forestry School (YF) and the Wood Collection of Harvard University (HU) is as follows:

Crateriform Pits Present

Cercidium australe Johnston: Argentina, Mendoza, *Mexia 4377* (GH); Argentina, La Rioja, *Cozzo* (*BA, 52235*); Argentina, Salta, *Cozzo* (*BA, 52722*), *Venturi 9507* (AA).

Cercidium praecox (R. & P.) Harms: Argentina, Jujuy, Ledesma, *Venturi 5343* (GH); Peru, Lambayeque, *J. West 3576* (GH); Equador, Loja, *Hitchcock 21331* (GH); Venezuela, *Pittier 12945* (AA), *Pittier* 1928 (*YF, 12458*); Venezuela, Llavo, *Curran* and *Haman 1251* (GH); Mexico, Sonora, La tinajo, *Hartman 241* (GH); Mexico, Sonora, *Abrams 13287* (GH).

Crateriform Pits Absent

Cercidium andicola Gris.: Argentina, Jujuy, *DeCarles* (*BA, 27/1102*); Argentina, Jujuy, Maimará, *Lorentz* & *Hieronymus 746* (GOET, TYPE); Argentina, Jujuy, Humahuaca, *Schreiter 11085* (GH); Bolivia, Toldos bei Bermejo, *Fiebrig 2493* (GH).

Cercidium floridum Benth.: Mexico, Nuevo Leon, *T. C.* and *E. M. Frye 2391* (GH); Mexico, Sonora, *Wiggins* and *Rollins 272* (HU, 25775); Mexico, Sinaloa, *Gentry 7016b* (GH); U.S., Arizona, *Pringle 1881* (AA).

Cercidium macrum Johnston: Mexico; Victoria, Tamaulipas, *Palmer 125* (GH); U.S., Texas, *Palmer 12303* (AA).

Cercidium microphyllum (Torr.) Rose & Johnston: U.S., Arizona; *Brass 14360* (GH); U.S., California, *Epling*, *Haines* and *Stewart 1933* (AA); *Pringle 1882* (AA); *HU 9678.*

Cercidium molle Johnston: U.S., Gulf of California, *Johnston 3877* (AA).

Cercidium peninsulare Rose: U.S., Gulf of California, Carmen Island, *Johnston 3802* (GH).

Cercidium sonora Rose & Johnston: Mexico, Sonora, *Abrams 13280* (GH).

Cercidium texanum Gray: U.S., Texas, *Buckley 1881* (AA).

The constant occurrence of crateriform bordered pits in two species of *Cercidium*, and their absence in eight other species, provides a diagnostic character of considerable significance; one which may be utilized by taxonomists in any future revision of the genus and its species. The character is so peculiar and unusual that it is indicative of close relationship between *C. australe* and *C. praecox*. It serves to differentiate these species sharply from *C. andicola*, as well as from North American representatives of the genus.

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